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Making sure planter technology accomplishes the basics

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Summary

Checking field conditions to make optimal planter adjustments such as the amount of down force on depth-gauge wheels is required for both automated and manual systems. Operator manuals include the importance of evaluating field conditions and setting adjustments accordingly for factors such as soil moisture, tillage, and texture.

Introduction

Placing seed at a uniform depth with adequate, but not excessive soil contact is a challenging task. Farmers are frequently unsure if and when planter adjustments should be made for varying soil conditions. Some are unaware of the need for operator monitoring and adjustment of new control systems. Planter technology advances can aid planting, but initial evaluation of soil and moisture conditions in the field and performance monitoring are still required by the operator for top performance. Instructions in operator's manuals for on-the-go down force adjustment systems caution that the proper amount of down force "depends" and encourage in-field checking and verification of seed depth and appropriate contact with soil.

Fundamentals

Seed depth is set on the planter as the distance between the bottom edge of the depth-gauge wheels and the bottom of the double-disc furrow opener (Figure 1). Frequently the weight of the row unit alone is not adequate to push the furrow opener into the soil to the bottom of the depth wheels. In this case, extra weight is transferred from the planter's toolbar frame through the parallel link attachment to the row unit using down pressure springs or a pneumatic bladder (Figure 1).

Transferring excessive weight on to the depth wheels ensures depth wheels remain in soil contact, but may compact soil on either side of the seed zone resulting in corn roots that follow the seed furrow but have difficulty penetrating compacted furrow sidewalls (often termed sidewall smearing or compaction, and causing a "tomahawk" shaped root system). The problem is more frequent in wetter soil conditions, but can occur with favorably "moist" soil if down force is excessive.

A common method to check and set down force is to operate the planter for a short distance, then attempt to manually "slip" depth wheels. If they can be slipped by hand, they aren't making enough soil contact to gauge depth. Down force is properly adjusted by adding enough down force so that wheels don't slip but not adding a significant amount of extra unneeded force that can compact soil in the seed zone. In practice pressure is released on parallel links until wheels begin to slip, then a moderate amount of force is added back on to the row unit.

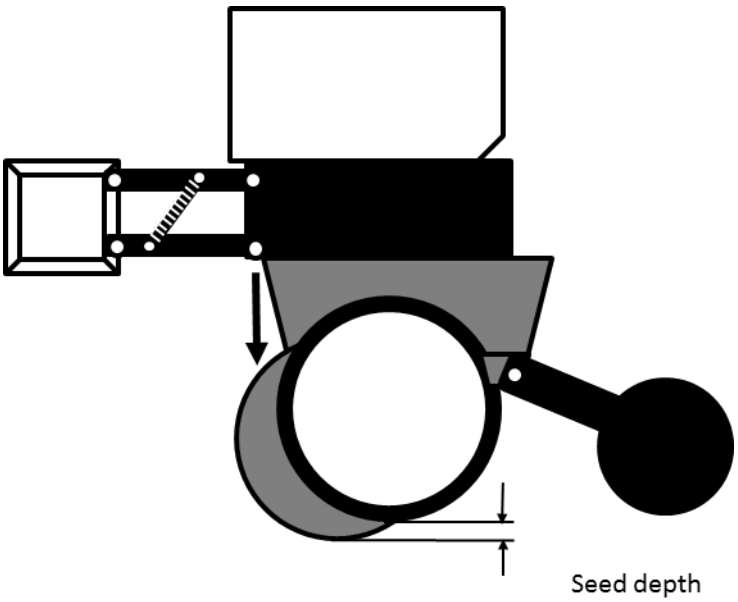

Figure 1. Down force is transferred from the toolbar frame by the parallel links to maintain ground contact of depth-gauge wheels used to establish seed depth.

On-the-go down force systems

On-the-go depth-wheel load adjustment systems measure and monitor contact force of depth wheels on the soil surface by use of a load cell (transducer that measures force). This information is used to readjust the amount of down force being transferred through the parallel links by a pneumatic or hydraulic system.

Contact force of wheels on a field soil surface is constantly varying, particularly as travel speed increases. Consider vehicle "bounce" as you drive a pick-up truck or lighter weight vehicle across a field surface or ride a bicycle off-road. Figure 2 is an example of load force measured on planter depth wheels over about 30 ft of travel with the planter operating at 5 mi/h in a no-till field. A planter would travel this distance in 4 seconds at 5 mi/h or 3 seconds at 7 mi/h.

Contact force changes quickly. Monitor displays usually average short time periods (e.g. 3 seconds) to improve operator ability to read displayed values. Averaging sensed load force over short time periods or sensing load on only one or two row units per toolbar frame section helps to dampen excessive acceleration forces that could rapidly oscillate the row unit up and down, creating bounce in the seed metering system and seed tube.

Rapid variation in contact force of depth wheels on the soil (Figure 2) creates the potential for no (zero) load on the wheels and shallower than desired seed depth unless average down force is set high enough to create a minimal (non-zero) load much of the time during operation. In addition to down force load, on-the-go systems provide some measure of wheel contact time, either as a percentage of time with contact load greater than zero or measuring excessive row unit acceleration and "bounce".

Maintaining enough contact pressure for a stable "ride" to avoid excessive bounce in the seed tube and meter, but avoiding excessive surface load from down force of the depth wheels are conflicting goals. As described for manual adjustment, proper down force setting is to transfer enough weight from the planter frame to maintain firm, but not excessive contact of depth wheels on the soil surface.

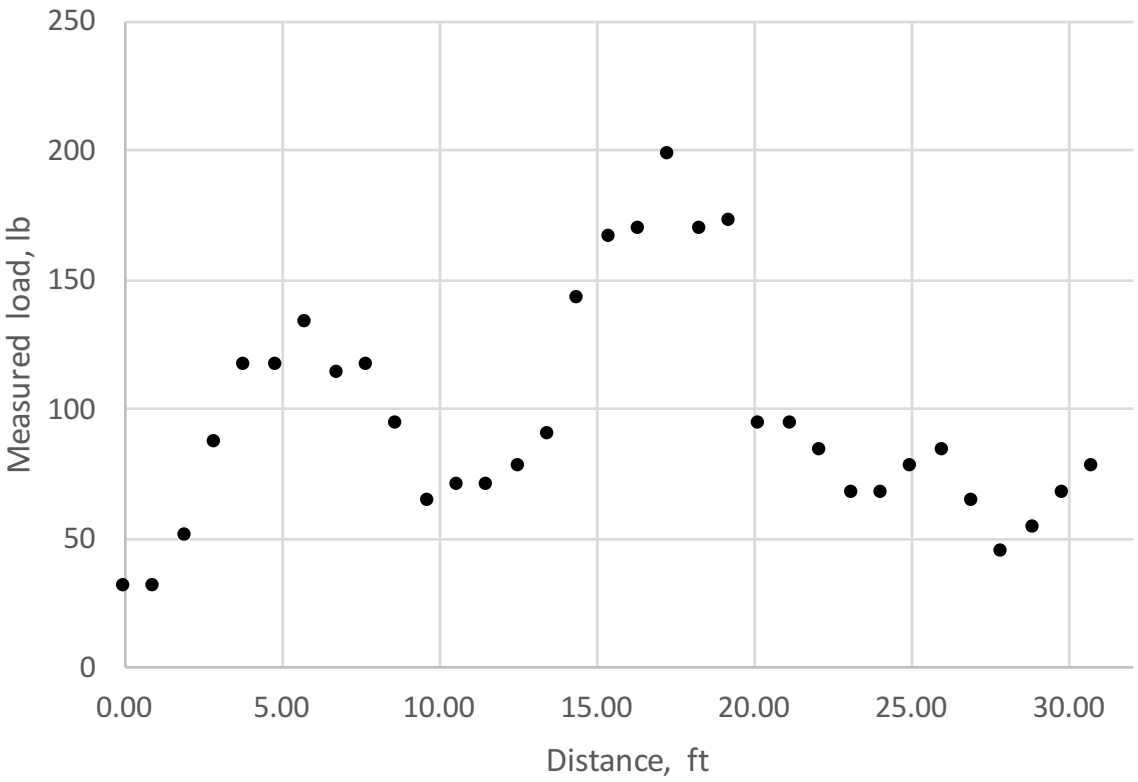

Figure 2. Contact force of depth wheels on soil during 30 ft of travel (about 4 sec at 5 mi/h or 3 sec at 7 mi/h.)

What to do?

Take the time to evaluate soil conditions (moisture, tillage, texture) at the start of planting each field. Consciously set down pressure on depth wheels (and also closing wheels). Stop the planter and take 3 or 4 minutes to check seed depth, soil contact, and furrow coverage at the beginning of the field and whenever a significant change occurs. A few extra minutes won't greatly impact field time, but could avoid major cost and expense associated with subsequent stand establishment problems.

If in-cab monitoring equipment is used, actively observe down force and ground contact to evaluate whether increasing or decreasing target down force on the depth wheels is warranted. Become familiar with how different adjustments effect seed placement to optimize benefits of the system.

Reference

Hanna, H. M., B. L. Steward, and L. Aldinger. 2010. Soil loading effects of planter depth-gauge wheels on early corn growth. Applied Engineering in Agriculture 26(4):551-556.